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How Fast Has Chinese Industry Grown?

Tom Rawski

An upward bias in measures of China's real industrial output in the past decade may substantially alter our perception of the rate and pattern of Chinese industrial growth. The extent of such bias should be investigated and analyzed for possible links with other economic patterns that may be more readily measurable.

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Data for recent years indicate an acceleration of Chinese industrial growth, from the annual rates of about 10 percent recorded in the quarter century before economic reform to figures approaching 15 percent in the mid- and late 1980s.

Evaluating the statistics underlying these reports requires an appraisal of how economic reform has affected the ability of China's statistical system to measure economic performance. Erroneous information about the rate and pattern of industrial growth could distort measures of productivity change considered to be central indicators of the effectiveness of Chinese industrial reform.

Rawski describes the statistical materials and procedures used to provide information on the growth of industrial output. He investigates sources of bias in the official statistics to indicate, whenever possible, how these biases affected reported output totals, and to appraise the impact of adjustments to reported output growth on measures of industrial productivity.

The specific consequences of decentralized decisionmaking, growing price flexibility, inflation, dual pricing systems, the emergence of enterprises with few or no ties to the system of state planning, and other emerging features of the industrial system may be unique to China but the broader issues raised are relevant in many countries.

Rawski finds considerable evidence of an upward bias in measures of China's real industrial output in the past decade. The issue is not whether such bias exists but whether its presence substantially alters our perception of the rate and pattern of Chinese industrial growth.

To clarify this issue requires investigating the extent of possible upward bias. This in turn calls for an analysis of possible links between upward bias — which is itself difficult to observe — and other economic patterns that may be more readily measurable.

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Tom Rawski
University of Pittsburgh

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I. Introduction

Data for recent years indicate an acceleration of Chinese industrial growth from the annual rates of approximately ten percent recorded during the quarter-century prior to the introduction of economic reform policies to figures approaching 15 percent annual growth during the mid- and late 1980s. Evaluation of the statistical materials underlying these reports requires an appraisal of how economic reform has affected the capacity of China's statistical system to measure economic performance. Since industrial output dominates China's national income totals, possible inaccuracies in statistics of industrial growth have the potential to affect overall measures of the size and structure of China's economy as well as perceptions about the size, structure and growth rate of the industrial sector itself. Of particular concern is the possibility that erroneous information about the rate and pattern of industrial growth will distort measures of productivity change, that we regard as central indicators of the effectiveness of industrial reform efforts in China's economy.

The objective of this paper is to describe the statistical materials and procedures that stand behind published information on the growth of industrial output, to investigate sources of bias in the official statistics, to indicate, whenever possible, the quantitative impact of these biases on reported output totals, and to appraise the impact of adjustments to reported output growth on measures of industrial productivity.

The problems explored in this paper arise primarily from the interaction between the growing complexity of industrial organization and market structure and a statistical network designed to collect information for the pre-reform system of industrial planning and administration. Although the specific consequences of decentralized decision-making, growing price flexibility, inflation, dual pricing systems, emergence of enterprises with few or no ties to the system of state planning, and other emergent features of the industrial system may be unique to China, the broader issues raised by these developments would seem applicable to other socialist economies at various stages of market-oriented reform programs.

II. Concepts and Categories for Chinese Industrial Statistics

Manipulation and interpretation of data pertaining to Chinese industry (which includes mining, manufacturing and utilities) requires an appreciation of important concepts and data categories used by Chinese statisticians. State enterprises (quanmin suoyouzhi) are those in which the legal ownership of post-tax profits resides in the hands of some level of the government. Nearly all of China's largest enterprises belong to this category, which accounted for 83.2 percent of industrial output in 1978 and 59.7 percent in 1987 [Industry 1949-84, p. 98 ;TJNJ 1988, p. 311]. Collective enterprises (jiti suoyouzhi) are those in which this residual ownership right resides with the enterprise itself. Residual profit of private or individual (geti) enterprise accrues to their owners.

The concept of "independent accounting units" (dulihesuan qiye) refers to industrial enterprises that function as separate accounting entities. Statistics for industrial output or input (fixed assets, working capital, labor) often refer exclusively to independent accounting units, which contributed 85.8 percent of national industrial output (including 96.1 percent in the state and 86.4 percent in the collective sector) to the 1988 gross value total [Jefferson, Rawski, and Zheng, Table 1; these data exclude village-level industry]. Industrial activity may occur within non-industrial units, as when transport companies repair their own equipment or when universities or other non-industrial entities operate factories whose accounts are subsumed within their own. The output value of these "non-independent accounting units" (feidulihesuan qiye) is incorporated into output totals that include all industrial production (rather than only that of independent accounting units).

The coverage of industrial production was expanded in 1984 to include industrial enterprises managed at and below the village level (formerly described as managed by the production brigades of rural communes). These enterprises were previously classified as part of agricultural rather than industrial production [Field 1988, pp. 584-585]. Recent publications have begun to retroactively incorporate this category into the industrial totals for previous years, leading to apparent inconsistency with previously published statistics (e.g. newly published labor figures for collective industry inclusive of "village-managed" enterprises are much larger than identically-labelled employment totals published in earlier sources not because of any change in underlying statistics, but merely because the "village-managed" enterprises were formerly included in the farm sector).

Industrial production statistics are valued in terms of "current" or "constant" prices. The current price value of industrial output indicates the value of each year's output according to the market prices of that year. For the vast majority of products that are sold in the year of production, output value at current prices is identical with sales revenue. From this perspective, the existence of multiple prices for individual products poses no conceptual or practical difficulty for Chinese accountants and statisticians.

Following Soviet example, China's economic statistics have long been calculated according to "constant" as well as current prices. Constant prices of 1952 were used for the period 1952-57; 1957 prices were in force from 1957-71; national statistics for the years 1971-81 are based on 1970 prices; and a 1980 price base has been in force since 1981. Calculations based on "constant" or fixed prices are made by multiplying quantities of output by the relevant "constant prices," the latter being supplied to enterprise accountants by planning and administrative agencies of the Chinese government.

It is important to note that, as economic reform leads enterprise managers to focus more closely on financial results based exclusively on current prices, the calculation of output value at "constant" prices becomes increasingly peripheral to enterprise objectives[1]. In the absence of

1. One official of China's State Statistics Bureau commented that this change enhances the veracity of reported data.

price indexes for industrial products, output value calculated at "constant" prices becomes the chief indicator of industrial growth and structure. Intertemporal comparisons within a time period spanned by a single set of fixed prices pose no difficulty. When the period of analysis crosses from one to another fixed price base, as in computing growth between 1975 and 1985, ratios of output totals in the bridging years 1957, 1971 or 1981 are used to link figures across time periods served by different sets of fixed prices. If a calculation crosses more than one such gap, e.g. when comparing the levels of industrial output in 1952 and 1987, a series of chain-linked calculations is used [see Field, JEC 1986, p. 509], and the resulting time series is described as being based on "comparable" (kebi) rather than "constant" (bubian) prices.

III. Chinese Industrial Perfofmance-Summary of Recent Official Data

Official statistics of China's industrial performance during the past decade indicate a rapid expansion of output coupled with considerable structural change. This is the picture that emerges from the summary figures presented in Tables 1-4.

Part A of Table 1 reproduces data on the growth of overall industrial output in constant and in current prices for a comprehensive industrial aggregate (designated "Industry+") that includes enterprises managed at and below the village level. Output totals for village-level industry are shown separately; subtraction of these figures from the global total generates an output series (designated as "Industry") restricted to enterprises operated at and above the township (xiang) level. Indexes of output growth from a 1978 base derived from these figures appear in Part B of Table 1; annual output changes for each category are derived in Part C.

These data indicate a continuation of the rapid and sustained growth that has characterized Chinese industry throughout the history of the People's Republic of China. Using the data at constant prices (labelled GVIO), the rate of output growth clusters around the 10 percent annual level observed over the long term in China. If village industry is excluded, the average annual growth rate of GVIO for 1978-87 is 10.4 percent. Even though village industry reported annual growth averaging 24.1 percent in real terms during 1978-87, the village component is so small that adding its inclusion in the total produces only a marginal increase in average growth to 11.3 percent for 1978-87. This is important because, as will be seen below, there can be little doubt that the figures shown in Table 1 considerably exaggerate the growth of real output in the village segment of industry.

The figures reported in Table 1 indicate a distinct acceleration of industrial growth during the mid-1980s, with reported real output growth approaching the 15 percent mark in 1983/84

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1. One official of China's State Statistics Bureau commented that this change enhances the veracity of reported data.

and 1986/87 and surpassing 15 percent in 1984/85 even without the inclusion of village-level industries.

Data showing the level and growth of industrial output at both current and constant prices can also provide information about changes in the price level for industrial goods. This is particularly important because Chinese sources give no systematic information on price trends for industrial goods until 1984/85; branch indexes for prices of industrial goods exist only from 1985/86 [China Price 2 (1989): 59]. Implicit price indexes for industrial output appear in Panel A of Table 1. These data reflect the gradual emergence of inflationary pressures beginning in the mid-1980s following years of near-stability in industrial prices. Whether these data accurately reflect trends in prices paid for industrial goods and/or received by industrial producers will be discussed below.

Table 2 indicates the breakdown of output into several ownership categories: state-owned, collective, private, and other. These figures show that output from the collective sector, particularly its sub-categories of township and village enterprises (jointly described by the term xiangzhen qiye), has grown much faster than production in state firms, leading to a rapid decline in the formerly dominant share of state firms in total output value.

The output totals in Table 2 are divided into two major sub-categories, state and collective. Additional detail is given for two segments of collective industry, firms managed at the township (xiang) and village (cun) levels within the collective sector. Since collective enterprises also operate in urban areas, these segments do not exhaust the entire output of China's collective industries.

Table 2 also displays output data for a separate category, xiangzhen qiye, which is often translated as "township and village enterprises" (abbreviated TVE), even though the term's literal meaning is "township and market-town enterprises." These data are of interest for two reasons: first, reported output has grown with extreme rapidity in recent years, so that the total amounts in 1987 to nearly one-third of national gross output. Furthermore, the scope of the TVE data remains uncertain for the period beginning in 1984. Prior to 1984, the TVE output data are almost precisely equal to the sum of output value at fixed prices for township and village enterprises. Beginning in 1984, however, we find a large and growing gap between output of township and village enterprises and the much higher TVE total. In addition, the price basis of the TVE data reproduced in Table 2 is not specified. We know that the data for 1978-83 represent the sum of output from township and village enterprise at constant prices. The enormous growth of the TVE category starting in 1983/84 suggests that the figures shown in Column E of Table 2 may represent output valued at current rather than constant prices.

Table 3 presents information on the branch structure of gross industrial output value at 1980 prices. These data, which exclude the minor category of non-independent accounting units and also exclude village enterprise, indicate very little change in the importance of major branches of Chinese industry during the past decade. This is confirmed by the rank correlation coefficient linking the size structure of industrial branches for combined state and collective industry (Panel

C of Table 2) in 1978 and 1987.[2] The stability of branch structure in both the state and collective segments of industry is a significant factor in analyzing trends in reported energy productivity. A stable branch structure eliminates the possibility of raising energy productivity by raising the share of industrial output produced in branches with low energy-intensity.

The figures in Tables 1-3 are based on the "gross value of industrial output," which represents the combined total of enterprise output values inclusive of material costs. Table 4 contains information on the growth of net industrial output, which is calculated by subtracting the value of material inputs (minerals, semi-fabricates. energy etc.) from gross output. The net value figures are usually rendered only in current prices; when net output is presented in constant price terms, the figures are apparently obtained by multiplying net output in current prices by the ratio of gross output totals in constant and current prices, which is equivalent to "single deflation" rather than the conceptually preferable "double deflation" used in contemporary industrial economies, in which separate price indexes are used to remove the impact of price change from gross output and from the intermediate goods purchased by industrial enterprises.

The general picture emerging from these data -- rapid growth, acceleration after 1983, with differentially rapid expansion of the collective sector -- parallels the results reported in Table 1. The ratio of net to gross output is nearly identical in the state and collective sectors. Following decades of near-constancy in this ratio [see Industry 1949-84, p. 41], we now see a gradual but steady decline in the net output ratio for both state and collective industry. There are several possible reasons for this change:

- changing product mix within individual branches of industry (note that stability of branch structure precludes change in this area as a source of decline in net output ratios).

- changing technology and efficiency in some branches relative to others.

- differential inflation of raw materials prices relative to prices of finished products.

- changes in the rate of double counting arising from response to new marketing opportunities, enlarged specialization and inter-enterprise division of labor, expansion of subcontracting, and growth of joint production and transprovincial cooperation

Of particular relevance here is the possibility that reform-induced increases in inter-enterprise specialization may have raised the growth rate of gross output value above the growth rate of real industrial product. This outcome is not certain: we lack systematic data on the ratio of interenterprise purchases to total output (both level and time-path of this ratio) for

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2. Branches 13 and 14, and also branches 11 and 12 are combined for this calculation because they are not distinguished in the 1978 figures; with 13 branches, the rank ordering of 7 (including the six largest branches) is identical in 1978 and 1987. The sum of squares of differences in rank ordering for the remaining 6 branches is 36.

various types of enterprises. In addition, some units, including the large and widely publicized Capital Iron and Steel Corporation, have taken advantage of reform policies to increase rather than reduce the degree of vertical integration, which has the opposite effect of causing gross value to lag behind the growth of real output.

IV. Symptoms of Upward Bias in Chinese Industrial Statistics

Careful inspection of Chinese statistical publications raises the possibility that recent output totals based on "constant prices" may exaggerate real output growth in the industrial sector. Indications of upward bias in the constant-price industrial output totals for the past decade appear from the following types of materials:

- apparent mismatch between growth of physical output and output value in certain branches of industry
- indications that township and village enterprise may confuse current and constant prices
- possible increases in the rate of double counting, which would have the effect of artificially increasing the reported growth of gross output
- indications that local governments may falsify industrial output statistics to gain administrative benefits attached to achievement of large output totals.
- evidence that industrial output data do not adequately reflect price increases that have become pervasive in recent years.
- indications that reported gains in energy productivity are unrealistically large, especially in the fast-growing machinery branch.

A. Mismatch between Output and Value Data

In some cases, the reported growth of real output value appears to outrun the expansion of physical output for major products. The most notable example of this occurs in the chemical industry, for which relevant data appear in Table 5. These data show that the arithmetic average of annual physical output growth for nine major commodities lags behind the reported growth of output value at constant prices for every year beginning with 1979/80. The positive difference between reported growth of real output value and production volume for major commodities ranges from 2.56 percentage points in 1986/87 to 12.66 percentage points in 1984/85.

It is, of course, entirely possible for real output to outgrow physical production of major commodities in a large and complex industry that turns out a wide range of products as well as

a variety of items within broad categories such as "plastics." Furthermore, the calculations reported in Table 5 give identical weight to each of the nine products. On the other hand, the size of some of the annual differentials is troubling. Is it reasonable to anticipate that chemical output could rise in real terms by 11 or 12 percent during years in which average output growth of major commodities amounted to only 3.3 percent (1983/84) or even declined slightly (1984/85)? At the very least, these results suggest the possibility of upward bias in the value data for one of China's larger industrial branches. Figures for the machinery industry raise similar, though less serious, issues.

B. Do Rural Industries Adhere to Standard Accounting Regulations?

The extraordinary growth of township, village, and "TVE" enterprises noted in connection with Table 1 raises questions about the veracity of the underlying output reports. In principle each enterprise is expected to compile output values based on both current and constant prices As reform causes managers to focus increasing attention on enterprise financial performance enterprise leaders (and presumably accountants and statisticians as well) pay growing attention to current cash flows. Despite the complexity arising from sales of similar products at multiple prices, output valued at current prices is closely related to enterprise sales revenue, and therefore appears to pose little conceptual or practical difficulty even for the inexperienced and unsophisticated accountants available to small rural enterprises.

To calculate gross output at fixed prices requires information about the fixed (1980) price o each item produced. Industrial ministries publish large compendia containing relevant price lists. Administrative units at all levels are responsible for passing on appropriate price information to enterprises under their jurisdiction. While this system has functioned smoothly for many years among large-scale enterprises in the state sector, the recent explosive growth of collective enterprise, especially in rural areas, raises the possibility that enterprises, their administrative superiors in township or county industrial bureaus, local statistical personnel, or all three group may have failed to implement the system of calculation in constant prices that is of crucial importance for industrial output statistics even though it is of little or no interest to enterprise personnel and perhaps to local government officials as well.

China's statistical system operates according to a vertical hierarchy in which each administrative level compiles and processes statistical reports received from its immediate subordinate in the bureaucratic structure. Thus national agencies receive material prepared by provincial agencies, which in turn rely on data compiled by municipal or county authorities, who base their reports on data from local enterprises. This means that statisticians at higher administrative levels cannot easily evaluate the quality of the raw data underlying the reports that arrive on their desks, particularly when, as in the case of rural industry, these reports come from literally thousands of widely dispersed units.

Under these conditions, it is entirely possible that data supposedly based on fixed 1980 prices could contain a substantial component based on (much higher) current prices. With inflation, substitution of current for constant prices imparts an upward bias to the resulting data. The view

that failure to implement accounting conventions artificially inflates reported output growth, especially in the TVE sector, is widely shared within the Chinese economics community. An experienced accountant now working with a TVE machinery producer insists that even in the capital, failure to adhere to statistical regulations is not uncommon in the TVE sector; in rural areas, neglect of these systems is said to be widespread [personal communication, May 1989]. Officials of the State Statistical Bureau [SSB] agree that output data from TVE enterprises are problematic, that current prices are often used to calculate output values identified as based on fixed prices, and that the output totals tend toward bias in the upward direction [personal communication, May 1989; May 1990]. A position paper issued by the SSB in response to claims that its figures exaggerate the rate of industrial growth in recent years points specifically to rural enterprise as the chief source of what the SSB sees as a modest upward bias in its estimates of real industrial growth [SSB 1988; World Herald 1988]. An external researcher reports that visits to Jiangsu enterprises in the xiangzhen qiye category do indicate extensive mixing of data in current and constant prices, with enterprise leaders finding it difficult to explain which data are based on which prices [personal communication, July 1989]. A paper prepared by personnel at China's State Statistics Bureau [SSB 1988] reports that industrial units at the township (xiang) level and above are required to submit monthly reports of GVIO at constant prices. The small, dispersed and numerous village-level, jointly operated (at or below village level) and private (geti) enterprises submit only annual figures, and these are in current rather than constant prices. Provincial and local statistical bureaux then adjust these submissions on the basis of coefficients derived from sample surveys or surveys of key enterprises. The SSB's position paper asserts that these procedures remove most, if not all of the shuifen (literally "water content") or upward bias from the output data associated with village-level industry. The SSB also points out that figures for these units are not included in monthly reports of industrial output [See World Herald 1988 for a summary of debate on the "shuifen"issue].

Despite this explanation from the SSB, examination of available data confirms the impression that output data for TVE enterprises, especially figures said to be based on 1980 fixed prices, probably overstate the actual expansion of real output, especially during recent years of extremely rapid enterprise formation. Prior to 1985, compilations of TVE data carefully specify which data are based on 1980 prices; more recent publications conspicuously omit any mention of the price base for output data pertaining to 1985 and subsequent years [TVP, 1978-85; TVP 1987; TVP 1988; TJNJ 1988, p. 294. Note that Agriculture 1988 gives TVE GVIO for 1987 at 1980 prices (p. 314) using the same data that appear with no price attribution in TVP 1988, p. 26].

Several specific examples can illustrate what appears to be considerable inconsistency in these data:

Data for Beijing industrial enterprises for (million yuan):

	1986	1987 Index 1986=100
1. Gross output, 1980 prices (GVIO)		
a. Including village and sub-village units	34858.07	39512.33113.3
b. Excluding village and sub-village units	32177.14	35723.28111.04
c. Difference: GVIO for village enterprise	2680.93	3789.05141.3
2. Village & sub-village output, current prices (CVIO)	2480.06	3382.27136.4
3. Ratio for village output: CVIO/GVIO	0.925	0.893

Source: Beijing 1988, pp. 255 (1a-b), 364 (2).

These figures imply that village level industrial output is higher in constant than in current prices. But a decline in average prices for industrial output between 1980 and 1986 is most improbable. These data also indicate that industrial prices continued to decline during 1986/87, which is definitely incorrect.

Shanghai industrial output figures for 1987 (million yuan) raise further questions:

	A 1980 prices	B	Ratio B/A
1. Township enterprises	5428	8122	1.496
2. Village enterprises	4361	5029	1.153

Sources: Shanghai 1988, p. 127 (A); TVP 1988, p. 26 (B)

The data marked "A," identified as based on 1980 prices, are much smaller than the figures marked "b," which appear initially without price attribution, but are also used to compile a total described as based on 1980 prices in a separate source [Agriculture 1988, p. 314 - this is a table of 1987 gross output for township and village industry by province "at 1980 prices"; although the line for Shanghai is blank, the national totals and data for other provinces are virtually identical with figures in TVP 1988, p. 26, which makes no mention of a price base].

Scattered data for several provinces imply improbable increases in labor productivity. GVIO for Tianjin's village enterprises reportedly increased by 81 percent between 1985 and 1987 even though employment rose by only eight percent [Tianjin 1988, p. 111]. In Liaoning, reported GVIO from township enterprises rose by 21 percent during 1986/87 despite a two percent decline in employment [Liaoning 1988, p. 508]. In Heilongjiang, township enterprises reported real output growth of 15 percent during 1986/87 while employment fell by one percent [Heilongjiang 1988, p. 291].

The impression of widespread substitution of current for constant price output figures is confirmed by Robert M. Field, who finds that "a large and growing number of provinces have not distinguished output [of village-level industry] in current and constant prices. . . . in 1985 the output of village and below-village industry in current and constant prices were identical for all provinces" [Field 1988, pp. 586-87, with emphasis added].

C. Has the Rate of Double Counting Increased?

Measuring industrial output growth using information about changes in the gross value of industrial output can produce misleading results if changes in industrial organization alter the frequency with which materials, components, and services are exchanged among enterprises. Assuming no change in real output, a trend in the direction of vertical integration (e.g. merger of iron mines with steel plants) will cause measured output to decline (the sale of iron ore to the steel mill disappears from reported GVIO). A trend toward interenterprise division of labor, on the contrary, will cause measured output to increase.

There are two reasons why one might expect the use of GVIO data to artificially inflate measures of industrial output growth during the 1980s. First, industrial reform has created new opportunities for inter-enterprise specialization and division of labor. Chinese economists and planners have long criticized the excessive vertical integration typical of Chinese industrial operations. Despite ample evidence that integration raises production costs, managers have persisted in building daerquan (large and complete) or xiaoerquan (small and complete) manufacturing establishments in order to limit their dependence on unreliable external suppliers. Economic reform has increased the availability and reliability of external suppliers for a wide variety of commodities and services. There are many reports of new sub-contracting arrangements, inter-provincial joint ventures and other institutional changes that point in the direction of an increase in the overall ratio of inter-enterprise transactions to real output within the industrial sector. [Note, however, the apparent counterexample of the Capital Iron and Steel Corporation, which has used new opportunities for independent decision-making to reduce its

reliance on external suppliers through such measures as building its own power plant and acquiring a fleet of ocean freighters.]

Even if there has been no trend toward inter-firm specialization at existing enterprises, the growing weight of rural and collective enterprises in the industrial output total has almost certainly brought a decline in average scale of industrial operations. This probably implies an increase in specialization simply because small enterprises lack the capacity to achieve the high degree of vertical integration typical of China's larger industrial units.

We thus have two reasons for anticipating an increase in the ratio of inter-enterprise exchange of materials and semi-fabricates independent of any shift in product mix or branch structure of industry. Such a change would build an upward bias into the output totals reported in Table 1. Such a change would also systematically reduce the ratio of net to gross output value, which is exactly what we see in Table 4. Since several other factors also influence the ratio of net to gross output, the downtrend in the ratio of net to gross output observed in Table 4, although suggestive, is not sufficient to demonstrate either the presence of vertical disintegration or its possible impact on measures of real output growth.

A more promising approach would be to look at levels and changes in the ratio of interenterprise purchase of energy, materials and semi-fabricates to gross output value in various subdivisions of the industrial sector. For example, the industry-wide average ratio of interenterprise purchases to gross output at current prices (CVIO) [call this ratio IEP/CVIO], can be expressed as a weighted average of distinct IEP/CVIO ratios for large and small industry. Thus:

$$[IEP/CVIO] = a[IEP1/CVIO1] + (1-a)[IEP2/CVIO2]$$

where 1 and 2 indicate large and small-scale industry and a is the share of the former in national industrial output.

I hypothesize that:

(1) the ratio [IEP/CVIO] is considerably larger for large than for small firms
(2) the weight attached to large firms, a, has declined in recent years
(3) economic reform tends to raise the ratio [IEP/CVIO] for both large and small firms

It should be possible to use panel data from a enterprise surveys to investigate both the level and time path of [IEP1/CVIO1] and IEP2/CVIO2]. Together with data on the parameter,it should be possible to obtain some rough quantitative idea of possible bias in the output figures arising from changes in industrial organization.[3]

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3. William Byrd observes that the foregoing discussion overlooks the possible impact of changes in the price of materials and intermediate goods relative to the price of final products; such changes might be systematically different for large and small firms.

D. Do Local Authorities Falsify Industrial Output Data?

Well-informed statistical personnel report the existence of incentives for exaggeration of industrial output growth by local governments in some regions of China. In Jiangsu, for example, municipalities that surpass threshold levels of industrial output (e.g. 1 billion yuan) are granted special privileges in the form of exemption from certain types of regulation (e.g. direct access to provincial funds vs. application through county offices). Falsification, if extant, presumably takes the form of inflating gross rather than net output [note that the former can be easily inflated by arranging exchange of materials or semi-fabricates among producers of similar commodities]. If so, falling ratios of net to gross output will be typical of entities with inflated gross output totals. Unfortunately, there are many other factors influencing this ratio, so that falsification might easily escape detection, especially if the amounts are small relative to local and national totals.

At the same time, other enterprises or localities may conceal some portion of their actual production in the hope of avoiding taxes.

E. Industrial Output Data Accurately Reflect Recent Inflation Experience?

After decades of considerable price stability, China has experienced growing inflationary pressures during the 1980s. Since Chinese price index compilation has previously focused almost exclusively on consumer prices, the impact of recent inflation on industrial prices is not easily discerned. The only systematic effort to monitor trends in industrial prices appears to come from the State Price Bureau, which now surveys price conditions in several thousand industrial enterprises and uses the resulting data to compile indexes of ex-factory prices for industrial products as well as purchase prices for major raw materials, fuels, and power [personal communication, May 1989]. Summary figures for 1984/85 and more comprehensive results, including price indexes for 15 industrial branches and purchase price indexes for eight classes of materials appear in the Bureau's journal [China Price 2 (1989): pp. 59-60].

These figures confirm that industry has experienced the inflationary trend reported for urban consumer goods, Annual increases for ex-factory prices averaged 8.7 percent in 1984/85, 3.8 percent in 1985/86, 7.9 percent in 1986/87 and well over 10 percent during the first eight months of 1988 [China Price 2 (1989): 59]. Price increases for materials, fuel, and power were substantially larger in each year [ibid., 60]. The influence of commercial intermediaries (including government agencies), in the inflationary process is visible if we compare trends in ex-factory prices of "mining products" and "raw materials" (these categories appear not to overlap) with trends in purchase prices for "all raw materials" (percent increases over the previous year):

	Ex-Factory Prices Mining Products	Purchase Prices Raw Materials	All Raw Materials
1985	108.8	110.9	118.0
1986	100.6	107.5	109.5
1987	114.1	106.9	111.0
Aug.1988	108.8	117.8	123.9

Source: China Price 2 (1989): 59-60.

Profitable intermediation, whether by state agencies or by legitimate or illegal private enterprise (sometimes involving persons with official connections) is an important componen of the "official speculation" (guandao) widely reported in the Chinese press. Beijing's large Yanshan Petrochemical Company reportedly "sold almost all their products to the State at official low prices" only to discover that "most of their products' users paid much higher market prices" for the same materials [China Daily 6-3-1989, p. 1].

Although inflation of industrial prices seems to have accelerated in recent years, substantial price increases certainly occurred prior to 1984/85. Data in Table 6 show a rising trend for coal prices paid by electric power plants beginning as early as 1978/79. Data for the construction industry show a consistent pattern of rising building costs from the start of annual time series data in 1978 [TJNJ 1988, p. 590]. Since these figures exclude land costs, it would appear that rising costs of construction materials, which prompted complaints in the Chinese press during the late 1970s, also date back to this period. Interview data collected by foreign researchers give a strong impression of rising machinery prices during the late 1970s and early 1980s [personal communication].

Information on prices paid by power plants for coal illustrates the possible inconsistency between information about inflation and the price changes implied by industrial output statistics. The electric power industry is dominated by large, state-owned enterprises. It seems reasonable to assume that thermal power plants obtain the bulk of their coal requirements through planned allocations at low official prices, and that they enjoy considerable protection from the "official profiteers" attacked in the Chinese press. This would imply that, relative to other consumers of coal, power plants are somewhat insulated from inflationary pressures, and that trends in their coal costs should understate the average rise in coal prices for the entire economy.

Data reproduced in Table 6 show that average coal costs in China's power industry have risen steadily since 1978. The index of coal costs, which should represent an underestimate o the average rise in coal prices, shows an increase of 88.9 percent between 1978 and 1987. The implicit price indicator calculated from gross output at current and constant prices for the coal industry, however, shows much smaller increases of 66.7 percent for the state sector and 48.9 percent for the (much smaller) collective mining sector. These data lead to the conclusion that the annual price changes implicit in statistics of gross output value at current (CVIO) and

constant (GVIO) prices probably understate changes in the sales price of coal received by the producers. Specifically, we anticipate that, if t indicates time, the ratio of annual output data CVIO(t)/GVIO(t) is too low.

Inconsistency among several data series raises the question of which is most likely to be in error. The conclusion that the ratio CVIO(t)/GVIO(t) is probably too small is based on the judgment that figures for average coal cost, which come directly from records of financial and material transactions maintained by large, well-established units, are less subject to distortion than synthetic calculations of output value. If the distortion is contained in the output figures, the previous discussion suggests the constant-price figures (GVIO) as the probable locus of difficulty.[4] This reasoning is not foolproof, but it appears that the most likely explanation of inconsistency between coal costs to the power industry and the GVIO and CVIO data relating to coal production is that the series of output value at fixed prices grows faster than the real value of industrial output in the coal industry.

Inconsistency between information about inflationary patterns and the price indexes implicit in China's industrial output statistics is not limited to the coal industry. More general difficulties become evident when one compares the implicit price indexes derived from output data for the state and collective segments of industry.

Despite the progress of economic reform, markets for Chinese industrial output remain heavily regulated. Many firms are obliged to sell substantial portions of their output at low controlled prices. Even when firms are allowed to sell output at "negotiated" or "market" rather than plan prices, they encounter numerous controls [Ishihara, 1989]. Government agencies set maximum prices, as when the State Price Bureau issues "upper price limits for means of production outside the plan," including petroleum products, aluminum ingots and steel products [Price Theory 3 (1988): 51-53). Extra-plan sales of steel and non-ferrous metal products are also restricted to designated commodity exchanges [Price Theory 5 (1988): p. 57]. These measures are clearly designed to contain and restrict the rise of industrial prices. "Jaw-boning," or personal official advice intended to limit price increases, has the same effect.

Each of these measures is directed primarily toward, and applied most forcefully to the activities of large, state-owned enterprises. Under conditions of excess demand in which government struggles to prevent prices from rising to market-clearing levels, it is difficult to doubt that small, widely dispersed collective enterprises encounter less restriction on product pricing than large, highly visible firms in the state sector. For this reason, there is a strong presumption that the rate of price increase for commodities produced in the collective sector will tend to outpace comparable inflation rates for similar products in the state sector.

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4. It is also possible that rising markups by commercial intermediaries have widened the gap between the prices received by coal producers and the prices paid by coal users for the growing portion of sales that occur outside the plan framework. However, Jefferson, Rawski and Zheng find no evidence of a general rise in markups for industrial intermediate goods.

Unfortunately, the price indexes derived from statistics of industrial output value point in the opposite direction. Table 7 shows that implicit price increases reported for the collective sector fall short of comparable state sector data in every year since 1978. Typically, reported inflation is the collective sector is half or less of reported inflation in the state sector. Comparison of annual inflation rates for state and collective industrial output within the same branch produces the same result. Between 1978 and 1987, nearly three fourths of the instances where comparable data exist (91 of 126 cases; 9 cases are excluded because of data incomparability), the implicit inflation is higher in the state sector. In recent years, this result is even clearer: during 1984/87, we find 35 instances of higher implicit branch price increases in the state sector compared with only 8 instances of higher price increases in the collective sector (two items are discarded as incomparable)[5]

These conclusions are not acceptable, particularly since data from the coal sector suggest that price indicators extracted from the reported growth of industrial output in constant and current prices already understate industrial inflation for the state sector. The figures shown in Table 7 suggest that output statistics for the entire collective sector, which now accounts for nearly one-third of industrial production, systematically understate the impact of inflation. If this is true, the most likely mechanism is that reported output value at fixed prices for China's collective industries systematically overstates the growth of real output during the 1980s, particularly in recent years of strong inflationary pressures.

F. Are Reported Gains in Energy Productivity Unrealistically Large?

Data reproduced in Table 8 indicate that China's industries achieved very substantial gains in energy productivity during the early 1980s. These figures, which exclude village industries (see below) indicate annual gains averaging 6.7 percent in real output per ton of standard coal equivalent. This compares well with figures for energy productivity in mining and manufacturing for major industrial nations showing average annual productivity growth of 2.6, 3.4 and 7.0 percent for West Germany, the United States and Japan respectively during the period 1973-86.[6] If correct, these figures indicate a highly effective response to energy shortages within Chinese industry, which accounts for more than two-thirds of China's energy consumption.

Many observers have noted that China's energy prices are much lower, in relative terms, than comparable prices in other nations and in the world market, and also that domestic energy prices have not risen in parallel with global market trends. Despite the inflexibility of official prices, the data in Table 6, showing that average coal prices paid by thermal power plants nearly

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5. These comments are based on a worksheet DEFLATE2.wk1.

6. Based on a separate worksheet NENGCOMP.wk1, which is not included in this paper.

doubled between 1978 and 1987, imply still larger increases in the marginal prices paid even by high-priority energy consumers in China's industrial economy.

Even where energy prices have not risen steeply, reports suggesting widespread energy rationing point to the binding nature of energy constraints across much of Chinese energy. Under these conditions, managers seeking higher financial returns will impute a high opportunity cost to inessential energy consumption even if direct costs are low. It thus seems reasonable to conclude that many Chinese managers feel intense pressure to economize on energy consumption.

Changes in industrial energy productivity can be decomposed into three components: changes in the branch structure of industry that decrease the relative weight of energy-intensive industries, reductions in energy requirements for producing specific commodities, and changes in the commodity structure of output within individual branches of industry. We have already seen that Chinese industry experienced no significant change in branch structure during the past decade (Table 3).

Review of Chinese publications, which include numerous descriptions of physical input-output coefficients related to energy consumption, suggest only modest gains from reduced unit energy requirements for specific products. Electric power consumed in producing one ton of crude oil or raw coal increased every year during 1980/85 [Energy 1986, pp. 86, 504]. Coal consumption per kilowatt of power turned out by large power plants or per ton of cement produced by major plants declined, but by less than five percent [ibid., 508, 527]. Since the share of output coming from small plants, which are criticized for their excessive energy requirements, has risen in many branches, the potential for major growth of energy productivity from reduced unit energy requirements for specific products seems very limited.

This leaves structural change within individual branches of industry as the main locus of improved energy productivity for Chinese industry during 1980/85. This conclusion is problematic because substantial intra-branch restructuring appears limited to a few branches - machinery, chemicals, and perhaps textiles. This outcome draws attention to the possibility that a portion of the productivity gains reported in Table 8 may be attributable to measurement error. To explore the possibility of measurement error, and also to investigate the branch pattern of change in energy productivity, we turn to an examination of energy data for 15 branches of Chinese industry during 1980/85.

Table 9 presents energy consumption data for 15 branches during 1980/85. Panel B uses these figures to derive annual percentage changes in energy productivity (GVIO/E, where E represents energy consumption in terms of standard coal) for 15 branches. These data contain a number of improbable items: can we believe, for example, that energy productivity in food processing rose by 27.3 percent during 1984/85, or that energy productivity in machine-building rose by 21.1 percent in the same year?

We can investigate the consistency of the data for energy consumption (not shown) and energy consumption per unit of GVIO by extracting the implicit branch figures for GVIO and comparing them with GVIO data from other sources. This is done in Table 10, which uncovers unacceptably large discrepancies for branches 9-14 in the 15-branch classification. Fortunately, data for the sectors that consume the largest quantities of energy, namely metallurgy, power, chemicals, building materials, and machine-building, are not involved in these inconsistencies.

Table 11 presents a recalculation of E/GVIO and of annual percentage changes in GVIO/E for 1980/85 based on published branch data for E and on information from other sources giving branch time series of GVIO. These revised data show fewer improbable entries (readers should ignore the problems in branches 13 and 14, which should be merged in a future recalculation). These results suggest that, among the major energy users, machinery, chemicals and, to a lesser extent, metallurgy, have achieved considerable success in raising energy productivity, while electricity and building materials have recorded much smaller gains.

The veracity of these data, however, depend substantially on the accuracy of GVIO data for chemicals and machinery - exactly the sectors for which comparison of physical production and value data indicate the possibility of upward bias in the value totals. Since energy productivity in these sectors, alone among the major using branches, rises much faster than the reported national average, this dependence is considerable. Removal of the chemical and machinery branches, which contribute over half of the overall energy savings attained during 1980/85 (Table 16) reduces the cumulative growth of energy productivity during 1980/85 from 28.6 percent to 17.3 percent (Table 16, Panel 1). If we were to assume that the growth of energy productivity in machinery and chemicals was limited to this lower amount, rather than the much larger figures shown in Tables 11B and 16, the average annual growth rate of the entire industrial sector (excluding village enterprises) during 1980/85 would be reduced by two percentage points, from 10.8 to 8.8 percent annually.[7]

Note, however, that the World Bank anticipates large reductions in unit consumption of electricity in the chemical branch because of slow relative growth of synthetic ammonia, "dramatic reductions" in unit power requirements for synthetic ammonia, and the international trend toward reduced power intensity in chemical manufacture [1985-A3, pp. 47-49]. Furthermore, Chinese specialists regard the materials contained in Energy [1986] as preliminary; this book was never released to the general public. However, it is my impression that data issued in subsequent publications (notably Energy [1989]), will support similar results.

The importance of energy issues and the major differences in scale and technology separating state and collective industry makes it important to provide separate analysis of energy consumption in state and collective industry. As far as I can determine, China's statistical agencies have made no effort to do this. Industrial census data giving energy consumption for

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7. This calculation is based on first column of Table 2B, following a separate worksheet "What if Energy Savings are Trimmed?" dated 7-4-1989.

state sector independent accounting units in 1980 and 1985 allow a trial calculation of energy consumption and energy productivity trends for collective industry during the period 1980/85.

NOTE: this can perhaps be extended to 1986 (using data in TJNJ 1988, pp. 424-436).

This is done in several steps:

(1) examine energy data for state sector independent accounting units divided into 40 branches;

(2) collapse data for 40 branches into 15 branches;

(3) obtain estimates of collective sector energy consumption in 15 branches for 1980 and 1985 by subtracting energy consumption by state-sector firms from the national totals underlying Table 9.

(4) calculate changes in energy productivity for the collective sector using derived or published figures of branch GVIO.

Energy data for 40 branches of industry in 1980 and 1985 are reproduced in Table 12, where I find no significant inconsistency between implied and published data for branch GVIO (readers should ignore the discrepancy for branch 7, which is trivial in size, and in the residual branch 40). Again, we see substantial increases in energy productivity over 5 years; again, these gains depend crucially on reported increases for a small number of branches that consume large amounts of energy and report above-average productivity gains: chemicals (branch 26); machine manufacture (branch 35).

These data can also be used to compute the "energy savings" arising from the presence of lower unit energy consumption coefficients in 1985 than existed in 1980. As before, two sectors, machinery and chemicals, dominate the calculated savings, accounting for 45 percent of the total amount (Table 16). If we were to assume that the path of energy productivity in these two branches paralleled the (considerably slower) gains reported for other branches of industry, the average annual growth rate for state industry during 1980/85 would decline by one percentage point, from 8.2 to 7.2 percent.[8]

Table 13 reports the result of calculations that collapse data for 40 state-sector branches into 15 branches and derive figures for changes in energy productivity for the 15 branches between 1980 and 1985. The transition from 40 to 15 branches is incomplete because it is not possible to make adjustments for 18 sub-branches (as is done in a separate worksheet, DATA87.wk1); the discrepancy, however, is not large. Energy productivity for 15 branches is calculated in two ways: first, using GVIO data that is derived from the 40-branch figures shown in Table 12; and second, using data from other sources that give GVIO for independent accounting units in the

8. This is based on Table 2 and a separate worksheet "What if Energy Savings are Trimmed?".

state sector according to the 15-branch classification in use before 1986. Although the differences between the two sets of calculations are not large (again, note that branches 13 and 14 should be merged), the latter figures are preferable. Here again we see the importance of machinery and chemicals, which are the only large branches reporting above-average growth of energy productivity.

Table 14 presents trial estimates of energy consumption and productivity change for 15 branches of collective industry during 1980/85. In Panel 1 of Table 14, branch energy consumption and branch GVIO are derived as residuals from the national totals and the state-sector figures presented above. Comparison of GVIO figures derived in this manner with published data showing branch GVIO for collective-sector independent accounting units at and above the xiang level (recall that the basic energy consumption data for 1980/85 appear to exclude village-level industry), reveals massive inconsistency. We therefore focus our attention on Panel 2 of Table 14, in which branch energy consumption for collective industries is derived as a residual, and then combined with published data on collective sector branch output to obtain productivity figures.

Scrutiny of these results yields the following observations:

1. There is a major inconsistency in data for the electric power industry, in which data for the state sector alone indicate much larger energy consumption in both 1980 and 1985 than for the entire power branch! As a result, the calculation reported in Table 14 indicates large negative energy consumption in the collective power industry for both years. Less worrisome discrepancies appear in branches 4 (in which the collective sector minute) and 14 (probably reflecting need to merge with branch 13).

2. Output value per unit of energy consumed (partial energy productivity) appears much higher in the collective than in the state sector.

3. If valid, the foregoing observation appears to be the result of differences in output structure rather than superior collective productivity on a branch-by-branch basis. Energy consumption per unit of real output by collective producers is markedly higher in branches 1, 6 and 9 (metallurgy, machinery, food processing) than in the state sector. Partial energy productivity seems to favor collective firms in branches 7, 8, 10, and 12 (building materials, forestry, textiles, leather), of which only 7 and 10 are major branches. In 7, the quality of small-plant output is far inferior to the state-sector norm [World Bank 1985-A3, p. 17]. Partial energy productivity is similar for state and collective firms in branches 5 (chemicals - here the comparison is blurred by major differences in product mix) and 11; the comparison is obscured by data problems for the remaining sectors.

4. Cumulative gains in energy productivity for the collective sector, summarized in Table 15, are far larger than comparable gains for the state sector in every significant branch except building materials (ignore the confused and minor branches 13-15). In most cases, the margin of difference is extremely large.

This last result seems quite improbable, and once again calls attention to the possibility of upward bias in available measures of real output growth for the collective sector.

A final point about energy data. There is a variety of material suggesting that overestimates of output growth may not be confined to TVE enterprises and the collective sector. Some examples:
Energy consumption per 10,000 yuan of output in Beijing's electric power industry dropped from 4.62 to 4.07 tons of standard coal during 1986/87, indicating a rise of 13.6 percent in energy productivity, even though coal consumption per kilowatt-hour of power produced did not change [Beijing 1988, pp. 291, 372].

Nationally, the electric power industry reports a 7.5 percent drop in unit energy requirements during 1980/85 (Table 11-B) even though coal consumption per kwh for large power plants (6000 kw and above), which produce a large share of total power output, declined by only 3.6 percent during the same period [Energy 1986, p. xxx].

The chemical industry reports that energy productivity increased by 12.6 percent in 1984/85 (Table 11-B). During the same period, however, 8 of 16 unit energy coefficients for major plants actually increased! The remaining eight coefficients declined by an average of 5.8 percent. Only 1 of 16 coefficients for major plants declined by more than the reported industry-wide average [Energy 1986, p. 87].

The building materials industry reported a 20 percent rise in energy productivity during 1980/85, but unit energy requirements at major plants decline by a maximum of 6.3 percent [Energy 1986, p. 88]

Reported energy productivity in coal production improved in every year but 1984/85 (Table 11-B), showing a cumulative gain of nearly five percent. Yet data for major enterprises show a rising trend for unit energy requirements; power consumption per ton of raw coal rises in every year [Energy 1986, pp. 86, 493-500]

V. Conclusions

This survey reveals considerable evidence pointing to the existence of upward bias in measures of China's real industrial output during the past decade. The issue is not whether such bias exists, but whether or not its presence substantially alters our perception of the rate and pattern of Chinese industrial growth.

To clarify this issue requires an investigation of the possible extent of upward bias. This in turn will require an analysis of possible links between upward bias, which itself is difficult to observe, and other economic patterns that may be more readily measurable.

TABLE 1: ALL INDUSTRY

A. Level of Industrial Gross Output, 100 million yuan

Year	GVIO Industry	GVIO Village	GVIO Industry+	CVIO Indus+	Price Index	Annual % Inflation
Data in 1970 prices						
1978	4231	161	4392	4237	96.47	
1979	4591	184	4775	4681	98.03	1.62
1980	4992	222	5214	5155	98.87	0.85
1981	5199	241	5440	5400	99.26	0.40
Data in 1980 prices						
1981	5178	246	5424	5400	99.56	N.A.
1982	5577	277	5854	5811	99.26	-0.29
1983	6164	325	6489	6461	99.57	0.30
1984	7030	460	7490	7617	101.70	2.14
1985	8295	661	8956	9717	108.50	6.69
1986	8979	841	9820	11194	113.99	5.06
1987	10307	1150	11457	13813	120.56	5.76

B. Index of Output Growth, 1978=100

1979	108.51	114.28	108.72	110.48
1980	117.99	137.89	118.72	121.67
1981	122.88	149.69	123.86	127.45
1982	132.35	168.55	133.68	137.15
1983	146.28	197.76	148.18	152.49
1984	166.83	279.91	171.04	179.77
1985	196.85	402.21	204.52	229.34
1986	213.08	511.74	224.25	264.20
1987	244.59	699.77	261.63	326.01

(continued)

TABLE 1: ALL INDUSTRY (continuation)

Year	GVIO Industry	GVIO Village	GVIO Industry +	CVIO Indus +	Price Index	Annual % Inflation
C. Annual Output Increase Over Previous Year (percent)						
1979	8.51	14.28	8.72	10.48		
1980	8.73	20.65	9.19	10.13		
1981	4.17	8.56	4.33	4.75		
1982	7.70	12.60	7.93	7.61		
1983	10.52	17.33	10.85	11.18		
1984	14.05	41.54	15.43	17.89		
1985	17.99	43.70	19.57	27.57		
1986	8.24	27.23	9.65	15.20		
1987	14.79	36.74	16.6	23.40		

Source: Rawski written files GVIO-tables.

TABLE 2: BREAKDOWN OF GROSS INDUSTRIAL OUTPUT AT CONSTANT PRICES
DATA EXCLUDE VILLAGE-LEVEL UNITS

	B	C	D	E	F	G	H
	Total	State	Collective Sector Categories				Xiang
			Total	Xiang-A	Xiang-B	Cun/Dui	zhen
1978	4231	3416	814	212	224	161	385
1979	4591	3720	871	234	241	184	424
1980	4992	3928	1034	280	286	222	509
1981	5199	4028	1131	310	321	241	579
1981	5178	4054	1089	323	332	246	579
1982	5577	4340	1193	354	369	277	646
1983	6164	4748	1354	413	432	325	757
1984	7030	5171	1758	539	575	460	1245
1985	8295	5840	2301	742	799	661	1827
1986	8979	6201	2637	948	2413		
1987	10307	6902	1217	3243			

	Check
	H-(F+G)
1978	0
1979	-1
1980	1
1981	17
1981	1
1982	0
1983	0
1984	210
1985	367
1986	2413
1987	3243

Source: Rawski written files GVIO-tables

TABLE 3: BRANCH STRUCTURE OF GVIO AT 1980 PRICES (PERCENT)

A. Branch Structure for State Enterprises (SOE)

Br	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	11.80	11.99	11.81	11.08	10.96	10.73	10.77	10.51	10.58	10.52
2	4.82	4.79	4.87	4.86	4.82	4.59	4.45	4.66	4.61	4.59
3	4.28	3.99	3.61	3.42	3.36	3.25	3.15	2.99	2 83	2.65
4	8.01	7.81	7.49	7.16	6.83	6.69	6.68	6.52	6.43	6.37
5	11.81	11.60	11.92	12.02	12.41	12.44	12.43	11.70	12.61	12.36
6	21.12	21.34	20.26	18.55	19.86	21.34	23.12	24.58	25.86	25.51
7	2.75	2.69	2.67	2.50	2.57	2.56	2.59	2.81	3.45	2.70
8	1.89	1.86	1.78	1.73	1.67	1.56	1.48	1.24	1.14	1.13
9	12.44	12.65	13.01	14.30	14.58	13.86	13.52	13.19	12.99	12.99
10	13.83	14.20	16.11	18.10	16.67	16.78	15.56	15.19	14.56	14.42
11	1.04	0.51	0.54	0.60	0.56	0.55	0.56	0.56	0.52	0.53
12	0.00	0.53	0.58	0.63	0.57	0.52	0.48	0.47	0.48	0.46
13	3.07	3.18	3.18	2.93	1.44	1.43	1.46	1.48	1.60	1.64
14	0.00	0.00	0.00	0.00	1.48	1.44	1.42	1.48	0.46	0.47
15	3.14	2.85	2.17	2.12	2.24	2.26	2.32	2.62	1.89	3.67
Sum	100.00	00.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

B. Branch Structure for Collective Enterprises (COE)

Br	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	1.97	2.28	2.34	2.17	2.32	2.47	2.54	2.89	3.39	3.56
2	0.11	0.15	0.17	0.21	0.23	0.25	0.22	0.20	0.20	0.20
3	2.27	2.12	1.94	1.87	1.93	1.94	1.92	1.64	1.63	1.42
4	0.12	0.13	0.13	0.11	0.11	0.14	0.13	0.15	0.18	0.21
5	10.94	10.74	10.76	10.93	11.45	11.94	11.26	10.94	11.17	11.30
6	36.07	34.84	32.63	30.38	30.68	31.55	30.95	33.27	32.83	33.07
7	8.37	8.63	8.32	7.91	8.57	8.46	8.17	7.50	8.89	7.51
8	2.55	2.73	2.72	2.64	2.71	2.52	2.33	2.23	2.85	2.28
9	2.96	3.39	3.70	4.39	4.69	4.71	5.04	4.96	5.37	5.46
10	7.90	8.58	10.04	11.92	12.08	12.26	16.02	16.3	15.76	15.96
11	11.28	9.36	10.49	10.96	9.59	9.22	8.44	7.10	6.39	6.22
12	0.00	2.35	2.94	3.05	2.58	2.34	2.09	2.08	2.17	2.20
13	5.48	5.06	5.35	5.53	5.26	4.61	1.02	1.01	2.45	2.61
14	0.00	1.02	1.02	1.06	1.08	1.08	4.18	5.13	3.62	3.94
15	9.97	8.61	7.43	6.88	6.74	6.50	5.71	4.59	3.11	4.07
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

(continued)

TABLE 3: BRANCH STRUCTURE OF GVIO AT 1980 PRICES (PERCENT) (continuation)

C. Branch Structure for SOE and COE Combined (percent)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	9.99	10.21	9.90	9.18	9.07	8.88	8.69	8.39	8.49	8.37
2	3.95	3.94	3.92	3.86	3.82	3.61	3.38	3.43	3.33	3.23
3	3.91	3.65	3.27	3.08	3.05	2.96	2.84	2.61	2.48	2.27
4	6.56	6.40	6.00	5.65	5.36	5.22	5.02	4.75	4.61	4.47
5	11.65	11.45	11.69	11.79	12.20	12.33	12.14	11.49	12.19	12.03
6	23.87	23.81	22.76	21.08	22.22	23.63	25.10	27.00	27.88	27.85
7	3.79	3.78	3.81	3.65	3.87	3.88	4.00	4.11	5.03	4.19
8	2.01	2.02	1.97	1.92	1.89	1.77	1.70	1.51	1.64	1.48
9	10.70	10.96	11.13	12.18	12.42	11.81	11.38	10.91	10.77	10.66
10	12.74	13.17	14.89	16.78	15.67	15.77	15.68	15.50	14.91	14.89
11	2.92	2.13	2.55	2.82	2.53	2.49	2.55	2.38	2.23	2.29
12	0.00	0.86	1.06	1.15	1.01	0.93	0.89	0.92	0.97	1.00
13	3.52	3.53	3.62	3.49	2.28	2.15	1.34	1.35	1.85	1.94
14	0.00	0.19	0.21	0.23	1.39	1.36	2.12	2.49	1.38	1.54
15	4.39	3.91	3.23	3.14	3.22	3.21	3.17	3.16	2.24	3.79
	100.00	100.00	100.00	100.00	100.00	99.99	100.00	100.00	100.00	100.00

Note: these data exclude village-level enterprises; they are confined to independent accounting units.

Key to branches:

1 metallurgy
2 power
3 coal
4 petroleum
5 chemicals
6 machinery
7 building materials
8 forestry and wood processing
9 food processing
10 textiles
11 apparel
12 leather processing
13 paper
14 cultural and art products
15 other

Source: Worksheet STRUCTURE.wk1

TABLE 4: NET OUTPUT AT CURRENT PRICES (100 MILLION YUAN)
INDEPENDENT ACCOUNTING UNITS, EXCLUDING VILLAGE ENTERPRISES

	Total	State	Collective	Xiang
1978	1358			
1979	1486			
1980	1648	1319	322	114
1981	1690	1317?	342	
1982	1774	1373	369	
1983	1930	1501		415
1984	2246	1721	506	183
1985	2767	2058	679	247
1986	2979	2178	763	296
1987	3488	2530	894	354

Source: Rawski written files GVIO-tables.

Net output ratio
(based on CVIO data for independent accounting units - not shown)

	Total	State	Collective
1978			
1979			
1980	0.35	0.351	0.348
1981	0.344	0.341	0.337
1982	0.336	0.332	0.334
1983	0.332	0.332	0.332
1984	0.333	0.340	0.314
1985	0.329	0.336	0.313
1986	0.316	0.322	0.301
1987			

TABLE 5: CHEMICAL INDUSTRY

	Average Percent Change physical output Nine Products	% Change GVIO,P80	Differential Growth of GVIO, percentage
1979	13.51	7.01	-6.60
1980	7.85	10.77	2.92
1981	-4.06	4.66	8.72
1982	7.30	11.43	4.13
1983	8.33	12.46	4.13
1984	3.30	12.04	8.74
1985	-1.05	11.61	12.66
1986	5.77	12.17	6.40
1987	14.52	17.08	2.56

Source: 1988 TJNJ, pp. 345-46 for commodity data; GVIO data are from Industry 1988, p. 54. These figures exclude village-level enterprises. Figures for 1978-80 were converted from 1970 to 1980 prices using the ratio of 1981 gross output for chemicals at 1980 and 1970 prices.

TABLE 6: ALTERNATIVE DATA TO MEASURE INFLATION IN THE COAL INDUSTRY

	A Cost/ton Std Coal Y/ton	B % change from past year	C Price Index 1978=100	CVIO/GVIO Annual Price % Change From Past Year SOE	COE	Cumulative Price Change Since 1978 Percent Power Plants
1971	43.77	N.A.	100.00			
1972	38.99	-10.92	89.08			
1973	39.86	2.23	91.07			
1974	43.10	8.13	98.47			
1975	44.17	2.48	100.91			
1976	44.70	1.20	102.12			
1977	44.80	0.22	102.35			
1978	42.06	-6.12	96.09			
1979	44.93	6.82	102.65	14.32	4.44	6.82
1980	46.18	2.78	105.51	7.25	1.38	9.80
1981	47.71	3.31	109.00	2.56	5.05	13.43
1982	55.40	16.12	126.57	1.66	4.99	31.72
1983	61.32	10.69	140.10	1.23	5.41	45.79
1984	64.01	4.39	146.24	2.71	3.82	52.19
1985	69.21	8.12	158.12	13.68	9.83	64.55
1986	75.21	8.67	171.83	5.13	2.01	78.82
1987	79.46	5.65	181.54	4.94	3.97	88.92

Source: Coal costs from Xu et al (1989); implicit price indexes taken from worksheet DEFLATE2.wk1.

TABLE 7: PRICE INDEXES EXTRACTED FROM INDUSTRIAL OUTPUT VALUE DATA

Year	PRICE INDEX SOE	PRICE INDEX COE	ANNUAL % CHANGE IN PRICE LEVEL SOE	ANNUAL % CHANGE IN PRICE LEVEL COE	SOE DIFFERENTIAL PRICE CHANGE percentage points
Combined Data for All 15 Branches					
1978	0.96	0.97	N.A.	N.A.	N.A.
1979	0.98	0.97	1.84	-0.12	1.97
1980	0.99	0.96	1.09	-0.60	1.69
1981	1.00	0.96	0.38	0.04	0.35
1982	1.00	0.95	0.10	-1.06	1.17
1983	1.00	0.95	0.05	-0.36	0.41
1984	1.02	0.96	1.95	0.72	1.23
1985	1.08	1.00	6.30	4.28	2.02
1986	1.12	1.01	3.33	1.50	1.83
1987	1.20	1.05	7.07	3.71	3.36

Source: Worksheet DEFLATE.wk1.

TABLE 8: ENERGY PRODUCTIVITY IN CHINESE INDUSTRY, OFFICIAL DATA, 1978-87

Year	Energy Use Per 100 Million Yuan of GVIO (tons std. coal)	Annual Percent Change in Energy Productivity
1980	78411	n.a.
1981	72380	8.33
1982	70374	2.85
1983	67045	4.97
1984	62592	7.11
1985	56872	10.06
1986		
1987		

TABLE 9: OFFICIAL ENERGY DATA FOR CHINESE INDUSTRY BY BRANCH, 1980-1985

A. Energy consumption in tons of standard coal per 100 million yuan of GVIO at 1980 prices

branch	1980	1981	1982	1983	1984	1985
1	164549	156603	150471	147084	142632	132[illegible]
2	99124	99492	96161	93911	93926	92062
3	162468	157580	155472	152577	151079	156652
4	83429	76069	73443	69541	65960	60040
5	148546	136517	127091	118445	110716	98176
6	32538	31160	29269	25823	22886	18894
7	217821	215525	215280	209595	193233	180283
8	36959	37293	33711	38041	33546	34263
9	131594	127529	128454	135213	128038	100577
10	32537	31258	29761	30040	28645	28135
11	701	666	712	662	633	717
12	6839	6371	6721	5813	5054	5224
13	173163	144298	161236	168497	165408	154314
14	11482	12205	12169	12370	11549	11476
15	77476	73383	70686	66480	61444	58634
total	78411	72380	70374	67045	62592	56872

B. Annual percentage rise in GVIO per ton of standard coal consumed

branch	1981	1982	1983	1984	1985
1	5.07	4.08	2.30	3.12	7.56
2	-0.37	3.46	2.40	-0.02	2.02
3	3.10	1.36	1.90	0.99	-3.56
4	9.68	3.58	5.61	5.43	9.86
5	8.81	7.42	7.30	6.98	12.77
6	4.42	6.46	13.34	12.83	21.13
7	1.07	0.11	2.71	8.47	7.18
8	-0.90	10.63	-11.38	13.40	-2.09
9	3.19	-0.72	-5.00	5.60	27.30
10	4.09	5.03	-0.93	4.87	1.81
11	5.26	-6.46	7.55	4.58	-11.72
12	7.35	-5.21	15.62	15.02	-3.25
13	20.00	-10.51	-4.31	1.87	7.19
14	-5.92	0.30	-1.62	7.11	0.64
15	5.58	3.82	6.33	8.20	4.79
total	8.33	2.85	4.97	7.11	10.06

Source: Data taken or calculated from Energy 1986, p. 16.

TABLE 10: GVIO DATA FOR 15 BRANCHES (100 MILLION YUAN, 1980 PRICES)

A. Derived from Statistics of Energy Consumption and Efficiency, 1980-1985

branch	1980	1981	1982	1983	1984	1985
1	473.05	456.70	485.21	523.71	579.39	664.04
2	189.16	194.89	207.05	220.21	235.61	272.75
3	159.79	157.25	166.33	178.34	194.73	208.42
4	290.07	282.11	287.98	310.03	334.14	416.39
5	565.08	591.43	658.98	741.10	830.32	926.70
6	1121.77	1079.91	1225.19	1440.58	1756.97	2235.10
7	195.80	195.10	222.59	245.43	287.27	350.62
8	105.52	104.85	112.13	116.19	126.69	133.09
9	112.32	121.78	129.38	134.08	151.91	213.17
10	612.23	690.06	755.69	794.27	865.77	951.84
11	727.53	855.86	870.79	951.66	1090.05	850.77
12	128.67	147.54	141.35	153.11	178.08	199.08
13	51 63	58.56	55.69	57.03	62.21	76.47
14	26.13	69.64	73.96	81.65	92.65	108.05
15	168.18	172.25	188.72	212.70	250.80	309.55
total	4745.51	4946.81	5330.66	5900.37	6721.95	7962.79

B. Published GVIO data: SOE+COE Independent Units, 1980 prices

1	470.42	452.32	481.13	519.19	578.22	657.4
2	186.35	190.35	202.29	211.32	224.72	268.29
3	155.48	152.04	161.48	173.01	188.83	204.69
4	285.22	278.63	284.43	305.29	334.37	371.82
5	555.34	581.23	647.04	721.12	807.57	899.91
6	1081.82	1039.19	1178.18	1382.13	1670.42	2114.46
7	181.02	180.18	205.45	227.13	266.29	322.17
8	93.75	94.75	100.47	103.71	112.93	118.36
9	528.82	600.53	658.76	690.68	756.97	854.11
10	707.42	827.08	830.69	922.22	1043.18	1213.85
11	121.31	138.96	134.07	145.89	169.94	186.21
12	50.14	56.60	53.58	54.21	59.11	72.06
13	171.82	171.87	120.66	125.65	89.49	105.68
14	9.84	11.13	73.65	79.43	141.1	195.18
15	153.69	154.89	170.61	187.9	211.27	247.82
total	4752.45	4929.75	5302.49	5848.93	6654.41	7832.01

(continued)

TABLE 10: GVIO DATA FOR 15 BRANCHES (100 MILLION YUAN, 1980 PRICES) (continuation)

branch	1980	1981	1982	1983	1984	1985
C. GVIO discrepancy: derived - published as % of derived figures						
1	0.56	0.96	0.84	0.86	0.20	1.00
2	1.48	2.33	2.30	4.04	4.62	1.64
3	2.69	3.32	2.92	2.99	3.03	1.79
4	1.67	1.23	1.23	1.53	-0.07	10.70
5	1.72	1.72	1.81	2.70	2.74	2.89
6	3.56	3.77	3.84	4.06	4.93	5.40
7	7.55	7.65	7.70	7.45	7.30	8.11
8	11.16	9.63	10.40	10.74	10.86	11.07
9	-370.84	-393.14	-409.15	-415.11	-398.31	-300.67
10	-15.55	-19.86	-9.93	-16.11	-20.49	-27.53
11	83.33	83.76	84.60	84.67	84.41	78.11
12	61.03	61.64	62.09	64.59	66.81	63.80
13	-232.80	-193.49	-116.65	-120.31	-43.85	-38.20
14	62.34	84.01	0.42	2.66	-52.30	-80.64
15	8.62	10.08	9.60	11.66	15.76	19.94
total	-0.15	0.34	0.53	0.87	1.00	1.64
A7. Revised calculation: tons std. coal per Yi yuan GVIO,P80						
1	16.55	15.81	15.17	14.84	14.29	13.40
2	10.06	10.19	9.84	9.79	9.85	9.36
3	16.70	16.30	16.01	15.73	15.58	15.95
4	8.48	7.70	7.44	7.06	6.59	6.72
5	15.12	13.89	12.94	12.17	11.38	10.11
6	3.37	3.24	3.04	2.69	2.41	2.00
7	23.56	23.34	23.32	22.65	20.85	19.62
8	4.16	4.13	3.76	4.26	3.76	3.85
9	2.79	2.59	2.52	2.62	2.57	2.51
10	2.82	2.61	2.71	2.59	2.38	2.21
11	0.42	0.41	0.46	0.43	0.41	0.33
12	1.75	1.66	1.77	1.64	1.52	1.44
13	5.20	4.92	7.44	7.65	11.50	11.17
14	3.05	7.63	1.22	1.27	0.76	0.64
15	8.48	8.16	7.82	7.53	7.29	7.32
Total	7.83	7.26	7.07	6.76	6.32	5.78

TABLE 11: REVISED CALCULATION: ANNUAL PERCENT INCREASE IN ENERGY PRODUCTIVITY BASED ON PHYSICAL ENERGY CONSUMPTION AND PUBLISHED GVIO DATA

branch	1981	1982	1983	1984	1985	Cumulative Total 1980/1985
1	4.65	4.20	2.28	3.81	6.70	23.53
2	-1.23	3.50	0.57	-0.63	5.22	7.50
3	2.44	1.77	1.82	0.95	2.32	4.67
4	10.16	3.58	5.29	7.14	-1.97	26.19
5	8.81	7.32	6.33	6.93	12.60	49.51
6	4.19	6.39	13.08	11.81	20.53	68.93
7	0.96	0.06	2.99	8.65	6.25	20.09
8	0.81	9.68	-11.72	13.25	-2.32	7.98
9	8.08	2.50	-3.89	2.16	2.36	11.34
10	7.97	-3.67	4.64	8.83	7.76	27.63
11	2.49	-11.30	7.09	6.36	23.94	28.34
12	5.67	-6.33	8.00	7.83	5.50	21.60
13	5.83	-33.94	-2.69	-33.48	2.98	-53.40
14	-60.06	524.68	-3.84	67.57	19.36	379.90
15	3.89	4.37	3.90	3.17	-0.41	15.76
total	7.80	2.66	4.60	6.97	9.35	35.41

TABLE 12: ENERGY DATA FOR STATE SECTOR INDEPENDENT UNITS, 40 BRANCHES, 1980 AND 1985

A. Raw Data from Industrial Census

Branch	Energy Consumption 10,000 tons std. coal 1980	1985	Tons of std. coal per 10,000 yuan of GVIO 1980	1985
1	2283	2543	18.24	16.22
2	1084	1147	8.27	7.15
3	46	62	5.61	5.68
4	106	116	5.3	4.18
5	69	76	6.61	6.11
6	124	132	7.65	8.39
7	0.0001	0.0001	3.2	3.87
8	156	183	4.06	4.98
9	44	65	4.04	3.91
10	740	1120	2.21	2.31
11	311	447	5.64	4.53
12	36	68	0.41	0.43
13	1	5	0.68	0.2
14	952	1234	1.72	1.63
15	10	13	0.44	0.42
16	42	48	1.87	1.78
17	91	132	4.5	5.46
18	9	10	1.89	1.5
19	594	746	9.21	8.15
20	27	36	0.79	0.67
21	11	13	0.86	0.58
22	6	9	1.27	0.87
23	7431	9127	38.89	34.44
24	1560	1613	9.43	7.76
25	300	330	23.08	20.87
26	5829	6211	18.08	13.78
27	237	322	3.97	2.68
28	321	481	9.71	5.4
29	160	195	2.19	1.84
30	39	59	1.58	1.37
31	2631	3594	21.44	19.34
32	5687	6397	19.01	16.36
33	620	754	5.2	4.64
34	135	154	2.69	2.19
35	1170	1343	3.17	2.1
3	370	435	2.51	1.66
37	194	224	1.85	1.23
38	80	99	1.32	0.5
39	38	43	1.28	0.89
40	4	7	1.17	1.31
SUM	33548.00	39593.00	8.91	6.99

Source: Industrial census materials, 3: 346-355

(continued)

TABLE 12: ENERGY DATA FOR STATE SECTOR INDEPENDENT UNITS, 40 BRANCHES, 1980 AND 1985 (contiuation)

B. Analysis and Consistency Check: Energy Data for 40 branches of State Industry

Branch	% rise in energy productivity 1980/85	Derived GVIO Yi Yuan 1980	Derived GVIO Yi Yuan 1985	Published GVIO (Yi Yuan) 1980	Published GVIO (Yi Yuan) 1985	% diff. 1985
1	12.45	125.16	156.78		156.19	-0.38
2	15.66	131.08	160.42		161.14	0.45
3	-1.23	8.20	10.92		10.86	-0.51
4	26.79	20.00	7.75		27.79	0.14
5	8.18	10.44	12.44		11.99	-3.61
6	-8.82	16.21	15.73		15.75	0.11
7	-17.31	0.00	0.00		0.02	77300.00
8	-18.47	38.4	36.75		36.95	0.55
9	3.32	10.89	16.62		16.58	-0.26
10	-4.33	334.84	484.85		483.00	-0.38
11	24.50	55.14	98.68		96.83	-1.87
12	-4.65	87.80	158.14		156.90	-0.78
13	240.00	1.47	25.00		23.82	-4.72
14	5.52	553.49	757.06		754.70	-0.31
15	4.76	22.73	30.95		31.71	2.45
16	5.06	22.46	26.97		26.74	-0.84
17	-17.58	20.22	24.18		24.73	2.29
18	26.00	4.76	6.67		6.55	-1.75
19	13.01	64.50	91.53		90.30	-1.35
20	17.91	34.18	53.73		54.25	0.97
21	26.47	12.79	19.12		19.31	1.01
22	45.98	4.72	10.34		10.09	-2.46
23	12.92	191.08	265.01		263.85	-0.44
24	21.52	165.43	207.86		207.50	-0.17
25	10.59	13.00	15.81		15.85	0.24
26	31.20	322.40	450.73		449.98	-0.17
27	48.13	59.70	120.15		119.55	-0.50
28	79.81	33.06	89.07		90.12	1.17
29	19.02	73.06	105.98		106.12	0.13
30	15.3[illegible]	24.68	43.07		43.63	1.31
31	10.86	122.71	185.83		185.62	-0.11
32	16.20	299.16	391.01		391.90	0.23
33	12.07	119.23	162.50		163.94	0.89
34	22.83	50.19	70.32		69.52	-1.14
35	50.95	369.09	639.52		636.38	-0.49
36	51.20	147.41	262.05		261.30	-0.29
37	50.41	104.86	182.11		181.43	-0.38
38	164.00	60.61	198.00		196.43	-0.79
39	43.82	29.69	48.31		48.42	.22
40	-14.60	3.42	5.11		9.03	76.73
SUM	27.47	3768.28	5667.07		5656.77	-0.18

TABLE 13: ROUGH CONVERSION OF SOE ENERGY DATA TO 15 BRANCH FORMAT

Branch	Energy Cons. 10000t std coal 1980	1985	Derived Yi 1980	GVIO,P80 yuan 1985	Ton std coal per 10000 yuan GVIO 1980	1985	% Rise GVIO/E 1980/85
1. Using DERIVED GVIO DATA							
1	6459	7329	446.59	592.18	14.46	12.38	16.86
2	7431	9127	191.08	265.01	38.89	34.44	12.92
3	2583	2873	138.16	172.59	18.70	16.65	12.31
4	2644	2760	296.51	368.28	8.92	7.49	18.99
5	6265	6787	479.84	719.92	13.06	9.43	38.49
6	1987	2298	761.84	1400.32	2.61	1.64	58.93
7	2824	3802	149.36	214.00	18.91	17.77	6.42
8	256	325	63.41	67.59	4.04	4.81	-16.04
9	1087	1635	477.79	741.66	2.28	2.20	3.20
10	1273	1715	586.55	846.13	2.17	2.03	7.08
11	10	13	22.73	30.95	0.44	0.42	4.76
12	42	48	22.46	26.97	1.87	1.78	5.06
13	594	746	64.50	91.53	9.21	8.15	13.01
14	44	58	51.69	83.19	0.85	0.70	22.09
15	49	77	15.78	46.73	3.11	1.65	88.46
Sum	33548	39593	3768.28	5667.07	8.90	6.99	27.43
2. Using PUBLISHED GVIO data							
1	6459	7329	447.90	594.50	14.42	12.33	16.97
2	7431	9127	184.71	263.85	40.23	34.59	16.30
3	2583	2873	136.79	169.03	18.88	17.00	11.10
4	2644	2760	283.99	368.64	9.31	7.49	24.35
5	6265	6787	451.95	661.83	13.86	10.25	35.18
6	1987	2298	768.28	1390.66	2.59	1.65	56.51
7	2824	3802	101.09	159.09	27.94	23.90	16.89
8	256	325	67.56	69.88	3.79	4.65	-18.53
9	1087	1635	493.22	746.11	2.20	2.19	0.57
10	1273	1715	610.92	859.30	2.08	2.00	4.41
11	10	13	20.47	31.71	0.49	0.41	19.16
12	42	48	21.88	26.74	1.92	1.80	6.94
13	594	746	120.38	83.69	4.93	8.91	-44.64
14	44	58	0.00	83.65	*******	0.69	******
15	49	77	82.28	148.08	0.60	0.52	14.53
Sum	33548	39593	3791.42	5656.76	8.85	7.00	26.42

Note: "published" GVIO for 15 branches is from DEFLATE.wk1. Derived GVIO data comes from collapsing 40-branch GVIO figures implicit in the energy and energy/GVIO figures into 15 branches following the algorithm contained in worksheet DATA86.wk1, omitting sub-branch adjustments for which no data are available. "Yi yuan" means 100,000,000 yuan.

TABLE 14: TRIAL CALCULATION OF ENERGY CONSUMPTION AND PRODUCTIVITY FOR COLLECTIVE INDUSTRY (INCLUDING NON-INDEPENDENT UNITS AND "OTHER" OWNERSHIP FORMS) 1980 AND 1985

1. Using DERIVED GVIO figures

Branch	Energy Cons. 10000t std coal		Derived GVIO Yi P80		Ton std coal per 10000 yuan GVIO		% Rise GVIO/E
	1980	1985	1980	1985	1980	1985	1980/85
1	1325	1477	26.46	71.86	50.07	20.55	143.60
2	-5556	-6616	-1.92	7.74	2893.17	-854.85	-438.44
3	13	392	21.62	35.83	0.60	10.94	-94.50
4	-224	-260	-6.44	48.11	34.79	-5.40	-743.73
5	2129	2311	85.24	206.78	24.98	11.18	123.50
6	1663	1925	359.93	834.78	4.62	2.31	100.36
7	1441	2519	46.44	136.61	31.03	18.44	68.28
8	134	131	42.11	65.50	3.18	2.00	59.09
9	391	509	-365.47	-528.49	-1.07	-0.96	11.08
10	719	963	25.68	105.71	28.00	9.11	207.36
11	41	48	704.80	819.81	0.06	0.06	-0.65
12	46	56	106.21	172.11	0.43	0.33	33.11
13	300	434	-12.87	-15.07	-23.3	-28.81	-19.06
14	-14	66	-25.56	24.86	0.55	2.66	-79.37
15	1254	1738	152.40	262.81	8.23	6.61	24.43
Sum	3662	5693	977.23	2295.72	3.75	2.48	51.11

Branch	Published GVIO Yi Yuan, P80		Percent Difference (Derived-published) As percent of Derived	
	1980	1985	1980	1985
1	22.51	62.90	-14.93	-12.46
2	1.65	4.44	-185.92	-42.63
3	18.69	35.66	-13.56	-0.47
4	1.23	3.18	-119.10	-93.39
5	103.39	237.98	21.30	15.09
6	313.54	725.86	-12.89	-13.05
7	79.92	163.08	72.09	19.38
8	26.18	52.71	-37.84	-19.53
9	35.6	108.00	-109.74	-120.44
10	96.5	354.55	275.79	235.40
11	100.83	154.50	-85.69	-81.15
12	28.26	45.32	-73.39	-73.67
13	51.44	52.88	-499.77	-450.98
14	9.84	86.33	-138.49	247.30
15	71.41	87.86	-53.14	-66.57
Sum	960.99	2175.25	-1.66	-5.25

Note: published COE GVIO are from DEFLATE.wk1.

(continued)

TABLE 14: TRIAL CALCULATION OF ENERGY CONSUMPTION AND PRODUCTIVITY FOR COLLECTIVE INDUSTRY (INCLUDING NON-INDEPENDENT UNITS AND "OTHER" OWNERSHIP FORMS) 1980 AND 1985 (continuation)

2. Using Published GVIO Figures

Branch	Energy Cons. 10000t std coal		GVIO Yi P80		Ton std coal per 10000 yuan GVIO		% Rise GVIO/E
	1980	1985	1980	1985	1980	1985	1980/85
1	1325	1477	22.51	62.90	58.85	23.48	150.62
2	-5556	-6616	1.65	4.44	-3372.19	-1490.09	126.31
3	13	392	18.69	35.66	0.70	10.99	-93.67
4	-224	-260	1.23	3.18	-182.11	-81.76	122.74
5	2129	2311	103.39	238.08	20.59	9.71	112.14
6	1663	1925	313.55	723.80	5.30	2.66	99.42
7	1441	2519	79.93	163.08	18.03	15.45	16.72
8	134	131	26.18	48.48	5.12	2.70	89.39
9	391	509	35.60	108.00	10.98	4.71	133.03
10	719	963	96.50	354.55	7.45	2.72	174.33
11	41	48	100.83	154.50	0.41	0.31	30.88
12	46	56	28.26	45.32	1.63	1.24	31.71
13	300	434	51.44	21.99	5.83	19.74	-70.45
14	-14	66	9.84	111.53	-1.42	0.59	-340.43
15	1254	1738	71.41	99.74	17.56	17.43	0.78
Sum	3662	5693	961.01	2175.25	3.81	2.62	45.60

TABLE 15: PERCENT CHANGE IN INDUSTRIAL ENERGY PRODUCTIVITY FOR 15 BRANCHES, 1980/85

	Total	State	Collective+
1	23.53	16.97	150.62
2	7.50	16.30	126.31
3	4.67	11.10	-93.67
4	26.19	24.35	122.74
5	49.51	35.18	112.14
6	68.93	56.51	99.42
7	20.09	16.89	16.72
8	7.98	-18.53	89.39
9	11.34	0.57	133.03
10	27.63	4.41	174.33
11	28.34	19.16	30.88
12	21.60	6.94	31.71
13	-53.40	-44.64	-70.45
14	379.90	n.a.*	-340.43
15	15.76	14.53	0.78
Total	35.41	26.42	45.60

Sources: Tables 11, 12, and 13. Based on calculations using published rather than derived data for branch GVIO.

*Branches 13 and 14 should be merged in a revised calculation; underlying output data for these two branches are jumbled.

TABLE 16: DATA ON "ENERGY SAVINGS," 1980-1985

1. Industry Above the Village Level, 15 Branches

branch	Energy Use in 1985 10,000 Tons Std. Coal 1980 Relations A	Actual B	"Saving" (A-B)/B	Energy Savings 10000t	percent of total
1	10878	8806	0.235	2072	16.01
2	2699	2511	0.075	188	1.46
3	3418	3265	0.047	153	1.18
4	3155	2500	0.262	655	5.06
5	13602	9098	0.495	4504	34.81
6	7134	4223	0.689	2911	22.50
7	7591	6321	0.201	1270	9.81
8	492	456	0.080	36	0.28
9	2387	2144	0.113	243	1.88
10	3418	2678	0.276	740	5.72
11	78	61	0.283	17	0.13
12	126	104	0.216	22	0.17
13	550	1180	-0.534	-630	-4.87
14	595	124	3.799	471	3.64
15	2101	1815	0.158	286	2.21
total	58225	45286	0.286	12939	100.00
Excluding MB&CHEM	37489	31965	0.173	5524	42.69

2. State Sector Independent Accounting Units, 40 branches

1	2849	2543	0.120	306	4.09
2	1333	1147	0.162	186	2.48
3	61	62	-0.017	-1	-0.01
4	147	116	0.270	31	0.42
5	79	76	0.043	3	0.04
6	120	132	-0.087	-12	-0.15
7	0	0	639.000	0	0.00
8	150	183	-0.180	-33	-0.44
9	67	65	0.031	2	0.03
10	1067	1120	-0.047	-53	-0.70

(continued)

TABLE 16: DATA ON "ENERGY SAVINGS," 1980-1985 (continuation)

2. State Sector Independent Accounting Units, 40 branches

branch	Energy Use in 1985 10,000 Tons Std. Coal 1980 Relations A	Actual B	"Saving" (A-B)/B	Energy Savings 10000t	percent of total
11	546	447	0.222	99	1.33
12	64	68	-0.054	-4	-0.05
13	16	5	2.240	11	0.15
14	1298	1234	0.052	64	0.86
15	14	13	0.073	1	0.01
16	50	48	0.042	2	0.03
17	111	132	-0.157	-21	-0.28
18	12	10	0.238	2	0.03
19	832	746	0.115	86	1.15
20	43	36	0.190	7	0.09
21	17	13	0.277	4	0.05
2	13	9	0.424	4	0.05
23	10261	9127	0.124	1134	15.17
24	1957	1613	0.213	344	4.60
25	366	330	0.109	36	0.48
26	8136	6211	0.310	1925	25.74
27	475	322	0.474	153	2.04
28	875	481	0.819	394	5.27
29	232	195	0.192	37	0.50
30	69	59	0.168	10	0.13
31	3980	3594	0.107	386	5.16
32	7450	6397	0.165	1053	14.08
33	852	754	0.131	98	1.32
34	187	154	0.214	33	0.44
35	2017	1343	0.502	674	9.02
36	656	435	0.508	221	2.95
37	336	224	0.498	112	1.49
38	259	99	1.619	160	2.14
39	62	43	0.441	19	0.25
40	11	7	0.509	4	0.05
TOTAL	47070	39593	0.189	7477	100.00
SUM Less MB&Chem	34642	30508	0.135	4134	55.3

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